Volatility, Size, and Vertical Distribution of CCN in MASE

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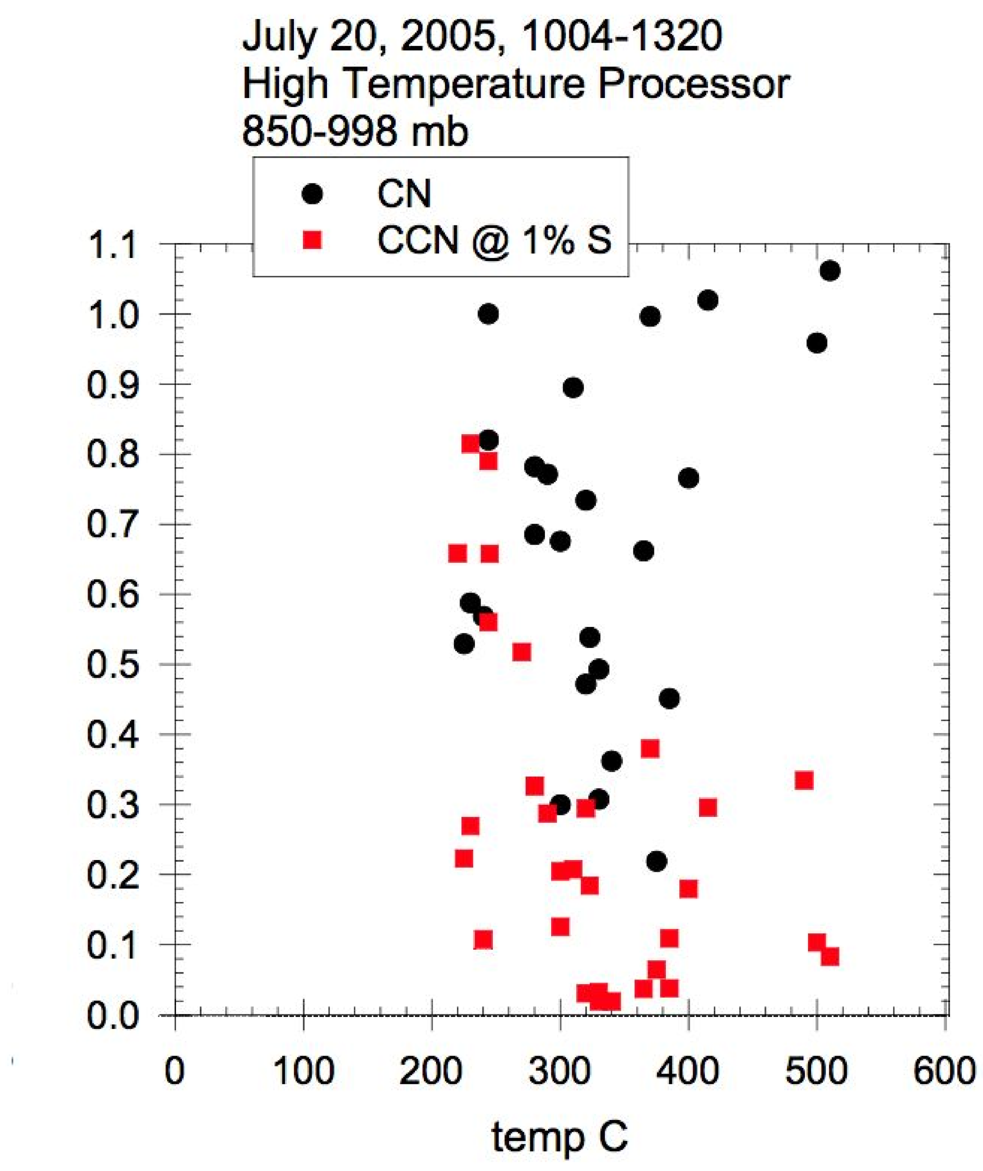
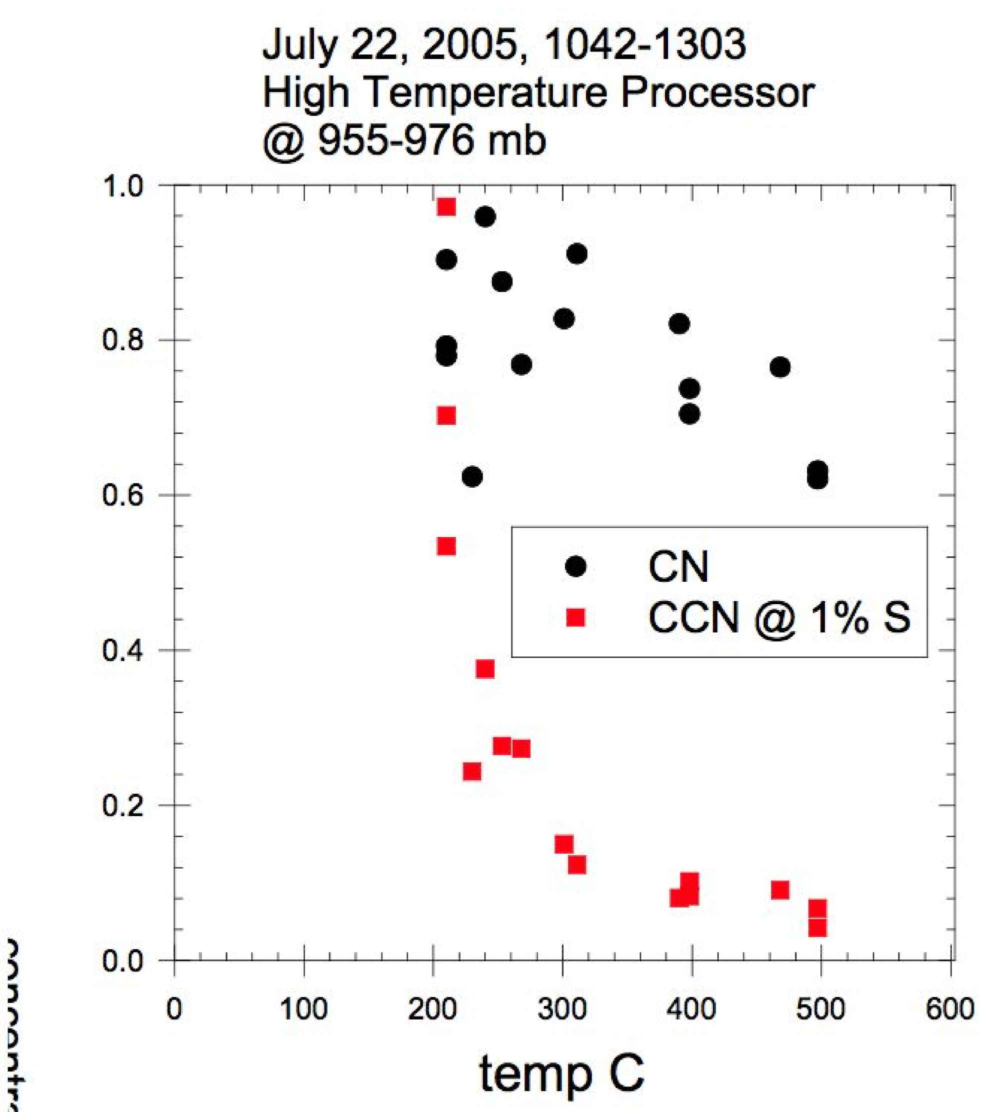
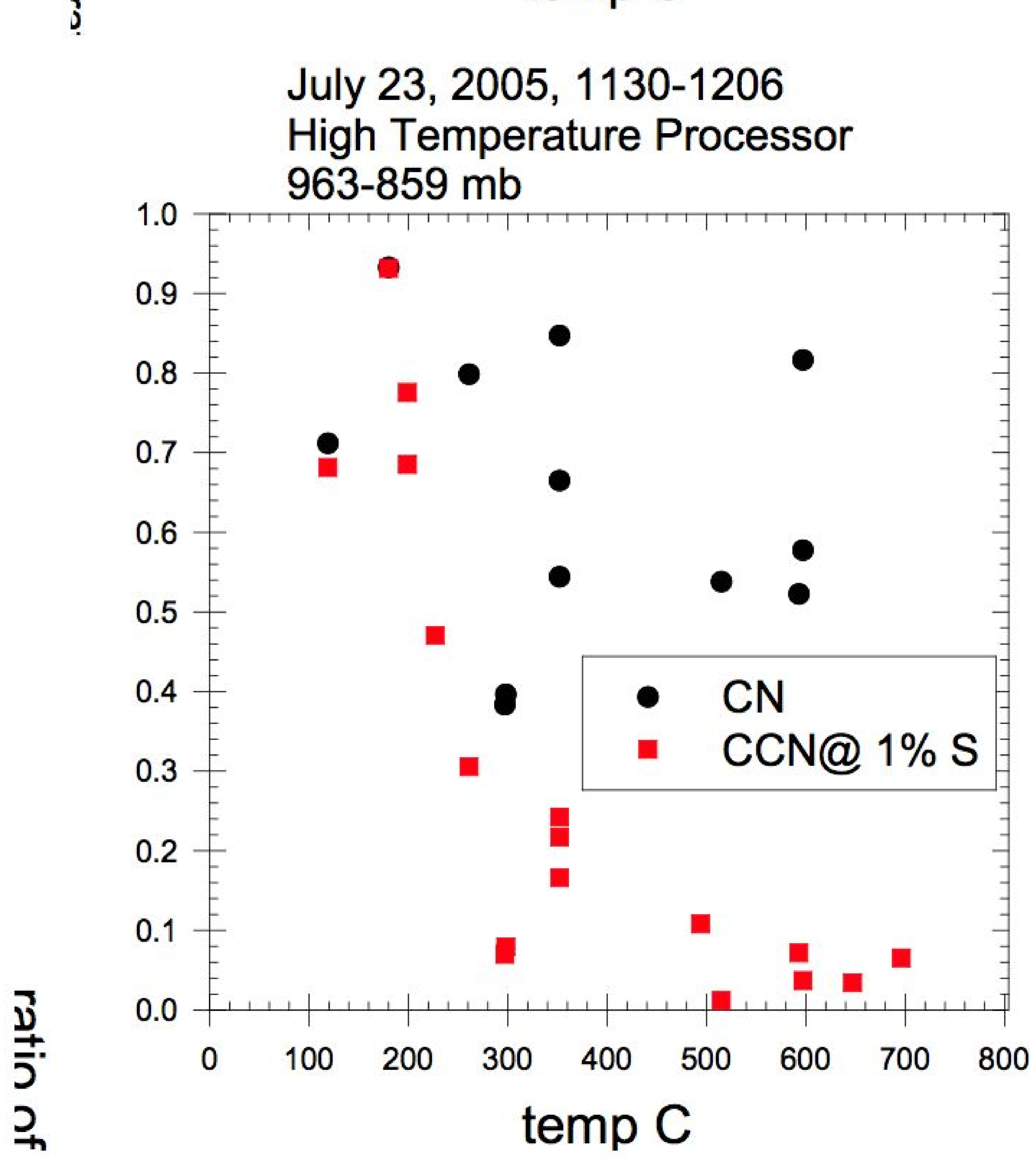
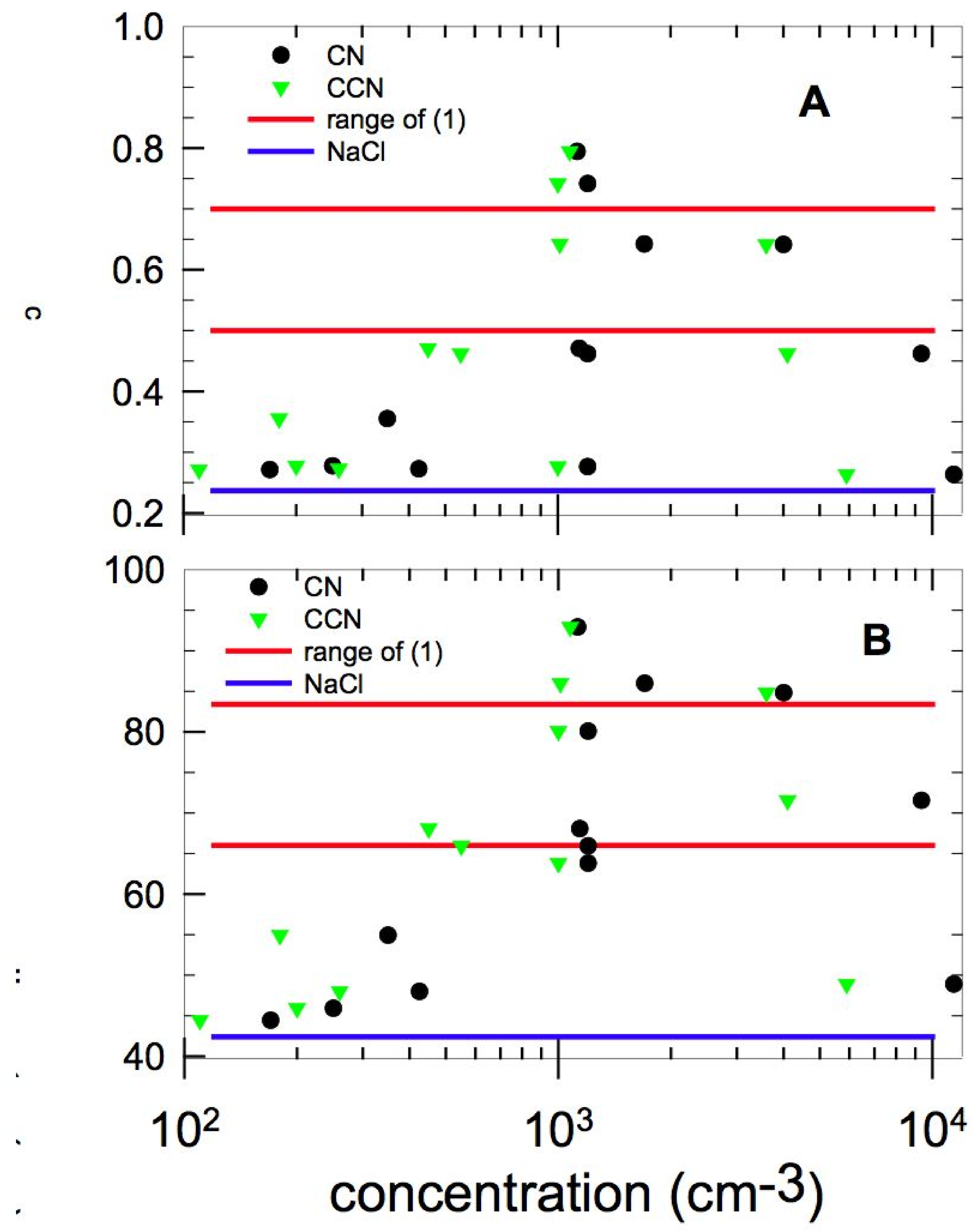




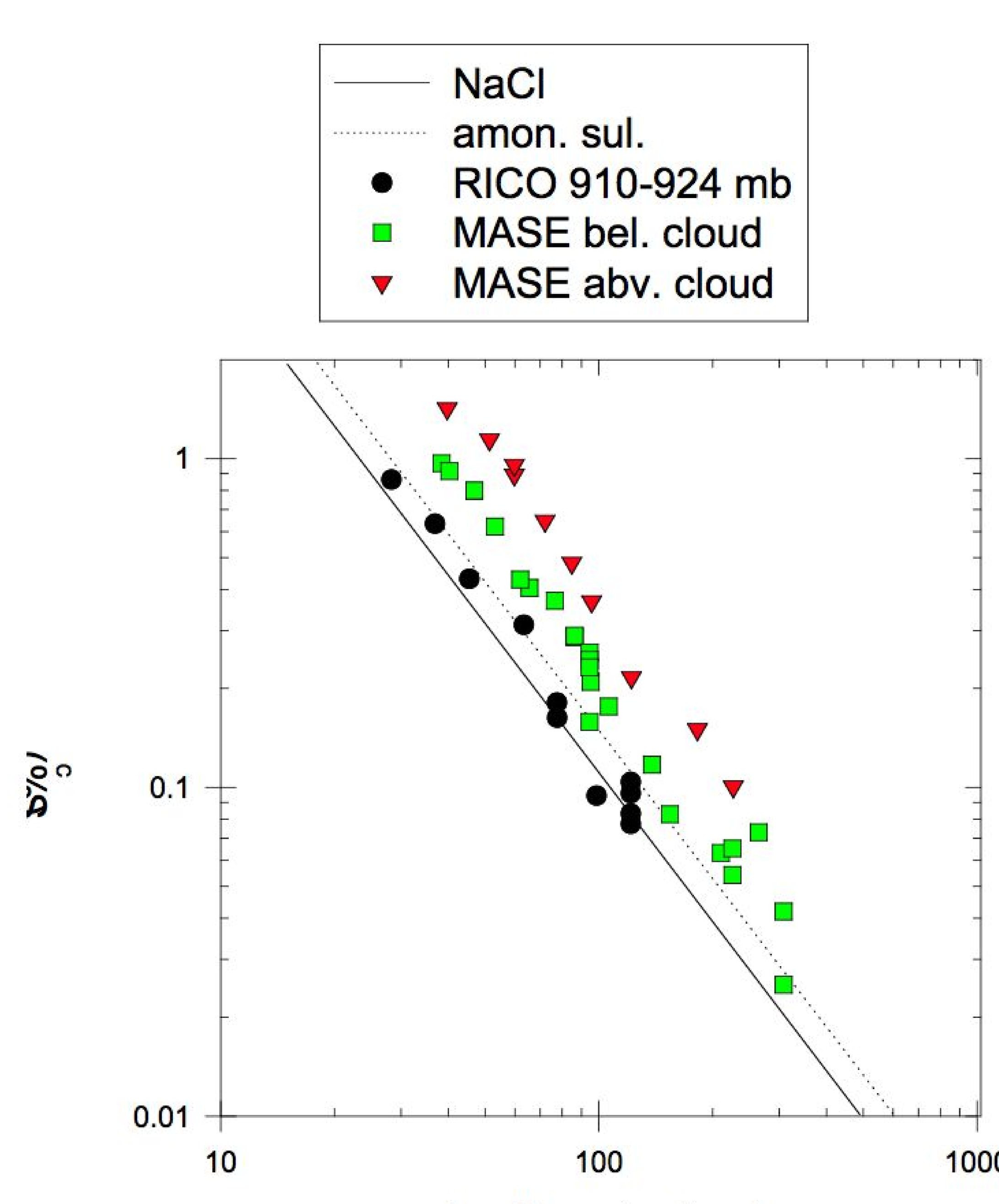


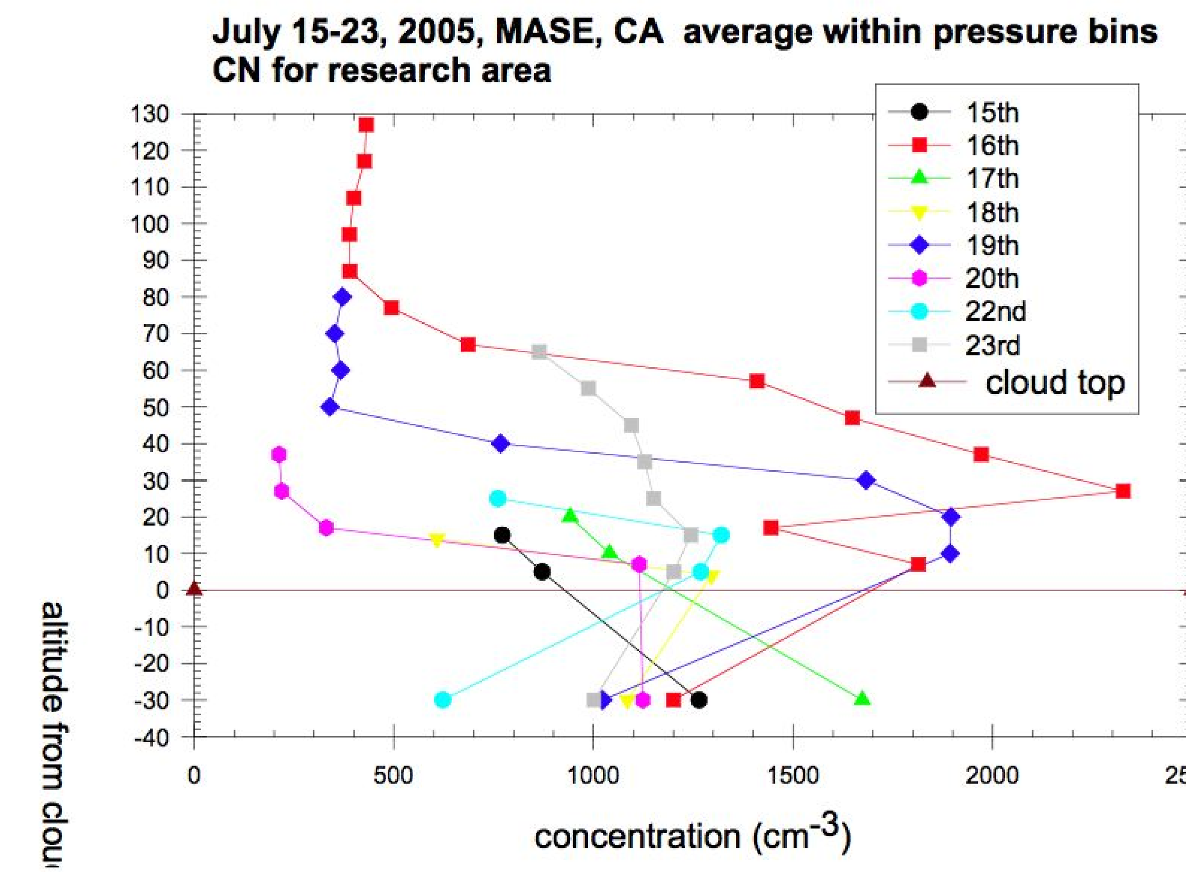
Above are volatility measurements on three days during MASE. This is done by passing the sample through an oven that can be heated to various specified and measured temperatures. A switching valve can be turned to put the sample through this high temperature processor (HTP) or to bypass it so that direct ambient samples can be done alternately every minute or so. Thus the HTP samples can be normalized to the ambient samples to determine the percentage of particles that are volatilized. Ammonium sulfate volatilizes at approximately 200°C depending on particle size. Here most of the CCN behave as if they could be ammonium sulfate. Most of the CN do not appear to be ammonium sulfate. They have higher and more variable volatility temperatures.

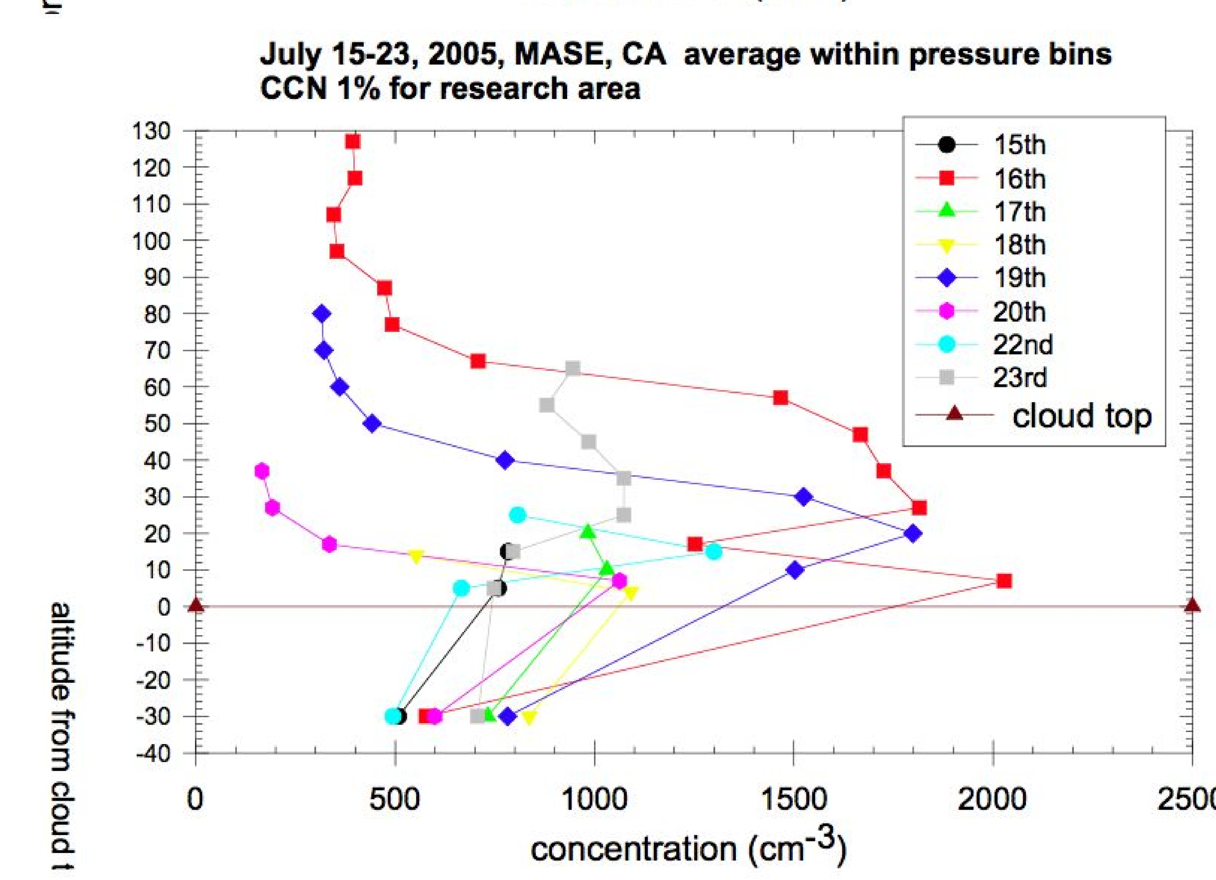


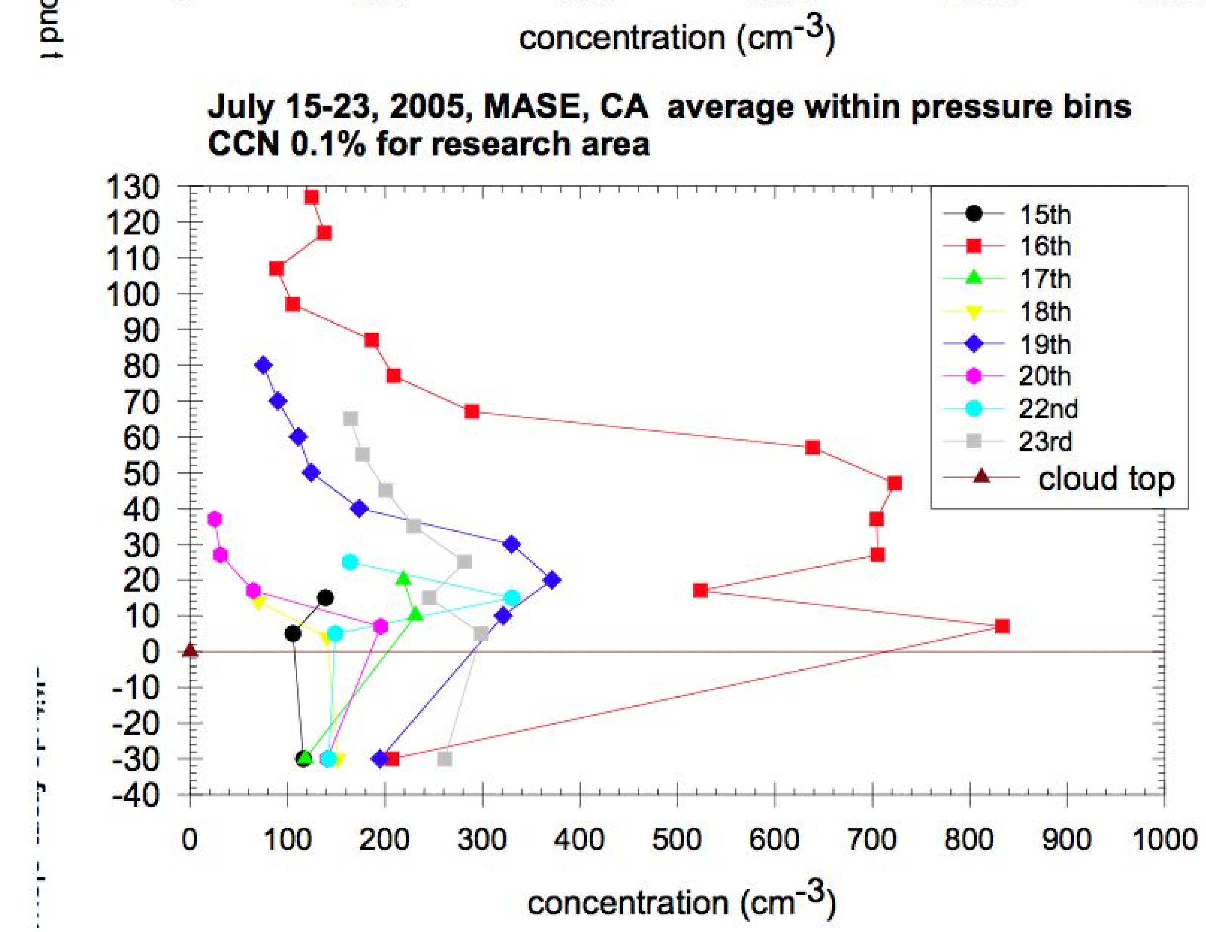
(A) Mean critical supersaturations (S_c) that were determined for 60 nm mean dry particle sizes as a function of simultaneous condensation nuclei (CN) and cumulative CCN concentrations (at approximately 0.5% supersaturation). The blue line denotes the S_c of 60 nm NaCl. The red lines denote the S_c range for 60nm dry particles reported by Dusek et al (2006; Science Mag, June). **(B)** Dry particle diameters that were determined for measurements at mean S_c of 0.4% as a function of simultaneous CN and CCN concentrations. The blue line denotes the dry size of 0.4% S_c NaCl. The red lines denote the range of dry particle diameters reported by Dusek et al. (2006) for 0.4% S_c particles. These measurements were obtained from MASE, AIRS2, and RICO.

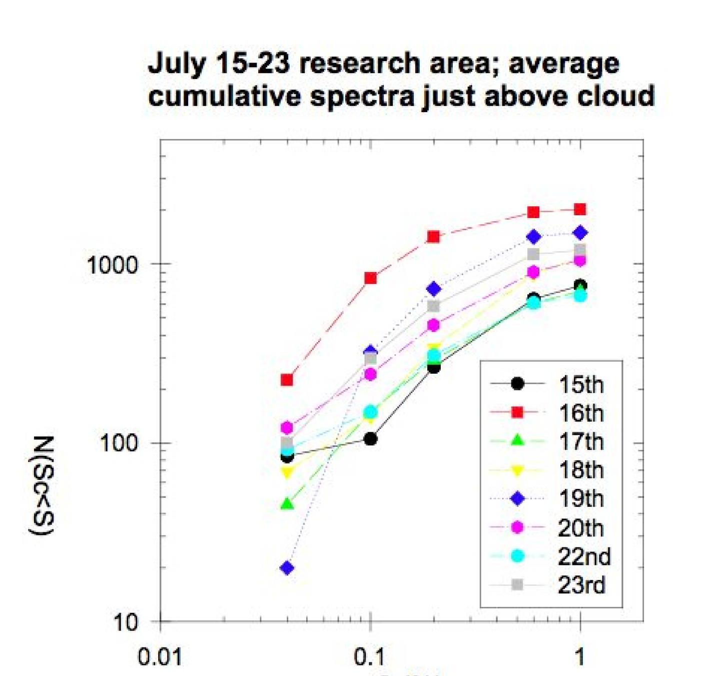
Below—Size versus critical S (S_c) measurements from MASE and RICO. Also plotted are the theoretical relationships for NaCl and ammonium sulfate. Agreement of the RICO data with these theoretical lines indicates nearly purely soluble particles as is usually the case in clean air. The less soluble MASE data is indicative of anthropogenic aerosol (Hudson and Da 1996 JGR) especially above cloud where a layer of high particle concentrations was usually found.

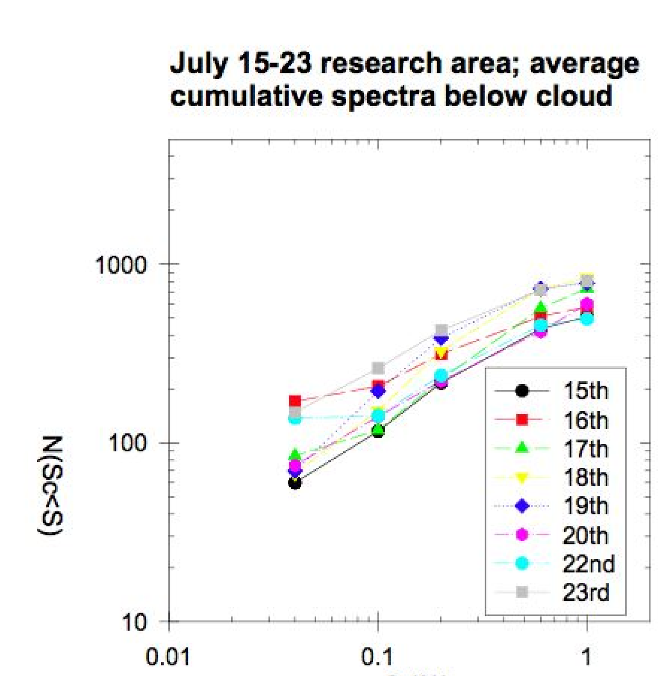












The top three figures of this column show the vertical distributions of CN and CCN in the research area of the MASE flights away from Pt. Reyes. Altitudes are normalized to cloud top. The below cloud (near surface) measurements are arbitrarily shown at -30mb in order to clearly display differences between below and just above cloud values. The lower two figures show average spectra below cloud and just above cloud top for each flight. These figures display the degree of variability of the particle concentrations among the flights and the usual higher concentrations above cloud than below.